Materials Engineering Branch

TIP*

No. 008 Effect of Gold Plating Thickness on Solder Joints

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The thickness of gold plating in tin-lead solder joints has been shown to have a significant effect on joint strength (the shear strength of the solder is reduced considerably as the percentage of gold is increased), metallic structure, and visual appearance. Several investigators have concluded that the gold reacts readily with tin-lead solders to form intermetallic compounds that are brittle and exhibit a sharp increase in melting temperature. The effects are measurable if gold is present in amounts greater than 5% by weight. It has also been shown that the wettability of gold plated copper surfaces by the solder is inferior to that of unplated fluxed or unoxidized copper. In some cases, even a thin gold plate (50-100 micro inches) can result in a high concentration of intermetallics at the bond line if the soldering procedure and conditions do not adequately dilute the gold concentration in the solder.

The primary function of gold plating is to protect the substrate material from atmospheric reactions such as the formation of oxides, sulfides, etc. However, electro-deposited gold plating is porous and, if not applied in sufficient thickness or as multiple layers, complete protection of the substrate material is not achieved. But with the thicker gold plating, the 5% level is easily exceeded when insufficient solder is used.

The question often arises as to whether or not the gold plating should be removed prior to soldering. Generally speaking, it is recommended that it be removed in the area to be soldered. Removal can be accomplished either mechanically (such as with an abrasive rubber eraser) or by reacting the gold with the molten solder and vacuuming or wicking off the gold-solder alloy. If the gold plating cannot be removed, cross-sectioning representative leads should determine its thickness. In addition, sufficient solder, heat, agitation and time should be used in making the joints so as not to exceed 5% gold content at the bond line. Additionally, representative samples should be prepared and tested for strength properties.